NOT MEASUREMENT SENSITIVE

KSC-STD-152-2C
May 15, 1992
Supersedes
KSC-STD-152-2B
June 7, 1991

GRAPHIC SYMBOLS FOR DRAWINGS

PART 2

GROUND SUPPORT EQUIPMENT

STANDARD FOR

ENGINEERING DEVELOPMENT DIRECTORATE

National Aeronautics and
Space Administration

John F. Kennedy Space Center

NASA

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STANDARD FOR

Approved By:

Walter T. Murphy
Director of Engineering Development

JOHN F. KENNEDY SPACE CENTER, NASA

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GRAPHIC SYMBOLS FOR DRAWINGS
PART 2
GROUND SUPPORT EQUIPMENT
STANDARD FOR

1. SCOPE

This standard establishes the requirements applicable to the graphic symbols used on ground support equipment (GSE) drawings prepared by or for the John F. Kennedy Space Center (KSC), NASA. This standard applies to those symbols used on structural, mechanical, electrical, and electronic drawings used to fabricate, install, or modify GSE and on other operations and maintenance documentation (OMD) drawings required for operation, maintenance, or other use of GSE.

2. APPLICABLE DOCUMENTS

The following documents form a part of this document to the extent specified herein. When this document is used for procurement, including solicitation, or is added to an existing contract, the specific revision levels, amendments, and approval dates of said documents shall be specified in an attachment to the Solicitation/Statement of Work/Contract.

2.1 Governmental.

2.1.1 Standards

John F. Kennedy Space Center (KSC), NASA

KSC-STD-E-0011	Electrical Power Receptacles Standard for

2.1.2 Drawings

John F. Kennedy Space Center (KSC), NASA

79K05763	Tube Fitting Symbols

2.1.3 Publications

John F. Kennedy Space Center (KSC), NASA

GP-435, Volume II	Engineering Drawing Practices, Facilities

2.2 Non-Governmental

American Institute of Steel Construction (AISC)

M015	Manual of Steel Construction - Load and Resistance Factor Design
M016	Manual of Steel Construction - Allowable Stress Design

(Application for copies should be addressed to the American Institute of Steel Construction, Inc., 400 North Michigan Avenue, Chicago, IL 60611)

American National Standards Institute (ANSI)

ANSI X3.5	Flowchart Symbols and Their Usage in Information Processing.
ANSI Y10.3	Letter Symbols for Quantities Used in Mechanics of Solids
ANSI Y10.20	Mathematical Signs and Symbols for Use in Physical Sciences and Technology
ANSI Y14.36	Surface Texture Symbols
ANSI Y32.10	Graphic Symbols for Fluid Power Diagrams

(Application for copies should be addressed to the American National Standards Institute, 1430 Broadway, New York, NY 10018)

American National Standards Institute/American Society of Mechanical Engineers ANSI/ASME)

ANSI/ASME B1.7M	Nomenclature, Definitions, and Letter Symbols for Screw Threads

(Application for copies should be addressed to the American Society of Mechanical Engineers, United Engineering Center, 345 East 47th Street, New York, NY 10017)

American National Standards Institute/American Welding Society (ANSI/AWS)

ANSI/AWS A2.4	Standard Symbols for Welding, Brazing, and Nondestructive Examination

(Application for copies should be addressed to the American Welding Society, 550 N. W. LeJeune Road, P. O. Box 351040, Miami, FL 33135)

American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

ANSI/IEEE STD 91	Graphic Symbols for Logic Diagrams
ANSI/IEEE STD 260	Letter Symbols for Units of Measurement
ANSI/IEEE STD 280	Standard Letter Symbols for Quantities Used in Electrical Science and Electrical Engineering
ANSI/IEEE STD 315	Graphic Symbols for Electrical and Electronic Diagrams

(Application for copies should be addressed to the Institute of Electrical and Electronics Engineers, Inc., 345 East 47th, New York, NY 10017)

3. REQUIREMENTS

The graphic symbols used on GSE drawings shall be in accordance with the following requirements.

3.1 General. - The graphic symbols used on a GSE drawing shall be shown on a legend located on the drawing sheet where the symbol is used or on a legend located at the front of the drawing. However, commonly used, easily recognized symbols may be omitted from the legend. A drawing note referring to KSC-STD-152-2 for identification of symbols may be appropriate in some cases. If an item does not have a symbol in this standard, a new symbol may be created by the responsible design organization, providing that the new symbol is included in a legend on the drawing. Graphic symbols shall be drawn to the size specified in the applicable reference.

3.2 Structural. - Graphic symbols used for identifying structural steel shapes on GSE drawings shall contain the standard abbreviations and nomenclature in accordance with AISC M015 or AISC M016. General use symbols, reinforced concrete construction symbols, and symbols for combination of structural shapes, flat-rolled metals, and timber construction shall be in accordance with GP-435, Volume II.

3.3 Welding and Nondestructive Testing. - Graphic symbols used for welding and nondestructive testing shall be in accordance with ANSI/AWS A2.4.

3.4 Mechanical. - The graphic symbols depicted in appendix A are based on the requirements specified in ANSI Y32.10 and shall be used in mechanical drawings in which the internal functions of electromechanical components need to be identified. These symbols show connections, flow paths, and the function of the component. The symbols also show conditions occurring during transition from one flow path arrangement to another. The symbols do not indicate construction characteristics such as material of which the component is made, and they do not indicate pressure, flow rate, or other component settings. The symbols do not identify locations of ports, positions of actuators, or the direction of shifting internal parts in actual components. Monodirectional or bidirectional symbolic representation of a component indicates the operational flow through the component and does not imply the design of the component.

The symbols for electropneumatic components shown in appendix A shall be used in all electromechanical control diagrams, and are the preferred symbols to be used in mechanical schematics. The symbols shown in appendix B may be used as alternate symbols when the internal functions of the components are not required.

The symbols used for tube fittings shall be in accordance with drawing 79K05763.

3.5 Electrical. - The graphic symbols depicted in appendix C shall be used in GSE electrical drawings, control diagrams, wiring diagrams, and schematics. The graphic symbols specified in ANSI/IEEE STD 315 may be used for items that do not have a symbol indicated in this standard. General wiring symbols shall be in accordance with the symbols shown in appendix C. Symbols for electromechanical components used on electrical schematics shall be in accordance with appendix C. Symbols used on communications drawings and diagrams shall be in accordance with appendix D.

3.5.1 Electrical Logic and Flow. - The graphic symbols used for electrical logic and flow drawings and diagrams shall be in accordance with ANSI/IEEE STD 91.

3.5.2 Flowcharts. - Graphic symbols used on flowcharts to represent the sequence of operations, flow of data, and the flow of paperwork for information processing shall be in accordance with ANSI X3.5.

3.5.3 Electrical Power Receptacles. - Graphic symbols for electrical power receptacles shall be in accordance with KSC-STD-E-0011. When an item is used that does not have a symbol listed in KSC-STD-E-0011, a symbol for that item may be used as specified in ANSI/IEEE STD 315.

3.6 Letter Symbols. - Letter symbols used on GSE drawings shall be in accordance with ANSI Y10.3, ANSI/ASME B1.7M, ANSI/IEEE STD 260, and ANSI/IEEE STD 280.

3.7 Mathematical Signs and Symbols. - Mathematical signs and symbols used on GSE drawings shall be in accordance with ANSI Y10.20.

3.8 Surface Texture. - Surface texture symbols used on GSE drawings shall be in accordance with ANSI Y14.36.

4. QUALITY ASSURANCE PROVISIONS

Not applicable

5. PREPARATION FOR DELIVERY

Not applicable

6. NOTES

6.1 Intended Use. - This standard is intended to establish uniform engineering practices and methods for the use of graphic symbols on GSE drawings at KSC.

6.2 Definitions. - For the purpose of this standard, the following definitions shall apply.

a. Cell: an organized group of lines and/or symbols that is composed and normally stored in the library of an automated drafting system for future use on drawings. Each cell is given a specific cell name by which it is retrieved and utilized in the preparation of drawings by the automated data system, thus eliminating any redundant effort in the reconstruction of commonly used graphic presentations. Also included are any composite graphic symbols or patterns of common usage in the preparation of engineering drawings in which a master (cell) is manually drafted for utilization in the various step-and-repeat processes made available through the reproduction facilities (e.g., washoffs, etc.).

b. Component: the smallest assembled item identifiable as a complete, functioning, hardware entity that performs a distinctive function in the operation of an item of equipment or a system.

c. Graphic symbol (basic): a simple delineation of a component, which is intended to emphasize its function and operation in a circuit. Basic symbols are used in single-line diagrams or elementary schematics and are basic building blocks for complete or composite symbols.

d. Graphic symbol (complete): the basic symbol of a component plus all the component features pertinent to a circuit. Complete symbols are used in advanced schematics to emphasize the functioning and interconnections of a circuit.

e. Graphic symbol (composite): an organization of basic and/or complete symbols with circuitry and all pertinent data pertaining to connections and item identifications, which is used to indicate flow paths and methods of operation of complex components or assemblies. Composite symbols may be further combined within a solid-line enclosure to represent a standard component cell.

f. Ground Support Equipment (GSE): all equipment necessary to support the operations of receiving, handling, assembly, test, checkout, servicing, and launch of space vehicles and payloads.

Custodian:

NASA - John F. Kennedy Space Center

Preparing Activity:

John F. Kennedy Space Center
Mechanical Engineering Division
Engineering Development Directorate

APPENDIX A

ELECTROMECHANICAL GRAPHIC SYMBOLS FOR GSE DRAWINGS (PREFERRED)

GENERAL REQUIREMENTS

The list of graphic symbols provided herein (see table A-1) shall be used in the preparation of GSE mechanical and electromechanical drawings in which the understanding of internal functions of the components is required. The symbols shown in this appendix shall not be used in conjunction with the symbols shown in appendix B.

The KSC computer-aided design (CAD) cell names are shown for the graphic symbols listed in table A-1. These CAD cell names are shown for easy reference in the preparation of computer-generated drawings. If a CAD cell does not currently exist for a symbol shown in table A-1, a dash is shown in the CAD cell name column.

The CAD cells containing the graphic symbols for CAD-prepared drawings are maintained in the KSC Standard Cell Library and are available for use in preparing KSC drawings.

Graphic symbols for regulators, switches, relief valves, transducers, gauges, and other similar components shall specify the range or setting of the components adjacent to the symbols.

The graphic symbols shown in this appendix shall be drawn at the full-scale size of the KSC CAD cell symbols.

Table A-1. Preferred GSE Electromechanical Graphic Symbols

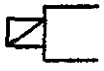
TITLE/DESCRIPTION	KSC CAD CELL NAME	SYMBOL
ACCUMULATOR	ACC	
ACCUMULATOR, GAS-CHARGED	ACCGC	
ACCUMULATOR, SPRING-LOADED	ACCSL	
ACCUMULATOR, WEIGHTED	ACCWE	
ACTUATOR, PUSHBUTTON	BUTACT	
ACTUATOR, LEVER, SPRING RETURN	LSRACT	
ACTUATOR, MANUAL	MANACT	
ACTUATOR, REVERSING-MOTOR	ACTRM	
ACTUATOR, SOLENOID	SOLACT	
ACTUATOR, SPRING	SPRACT	
ADJUSTABLE/SPRING	ADJSPR	

Table A-1. Preferred GSE Electromechanical Graphic Symbols (cont)

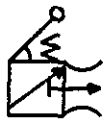
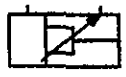
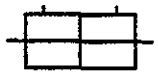
TITLE/DESCRIPTION	KSC CAD CELL NAME	SYMBOL
ADJUSTABLE/VARIABLE	ADJVAR	
BLOWGUN, PNEUMATIC	BLOGPN	
CABLE, ELECTRICAL	ELCABL	
COMPRESSOR, FIXED PLACEMENT	PMPPC1	
COOLER	COOLER	
COOLER, GASEOUS COOLING MEDIUM	CGCM	
COOLER, LIQUID COOLING MEDIUM	CLCM	
CYLINDER, FLUID, DOUBLE-ACTING, ADJUSTABLE CUSHION, ADVANCE AND RETRACT	CYLDA3	
CYLINDER, FLUID, DOUBLE-ACTING, ADJUSTABLE CUSHION, ADVANCE ONLY	CYLDA1	
CYLINDER, FLUID, DOUBLE-ACTING, ADJUSTABLE CUSHION, RETRACT ONLY	CYLDA2	
CYLINDER, FLUID, DOUBLE-ACTING, DOUBLE END ROD	CYLDA4	

Table A-1. Preferred GSE Electromechanical Graphic Symbols (cont)

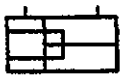
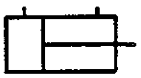
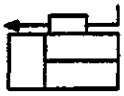
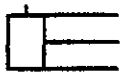
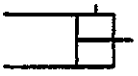
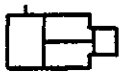
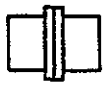
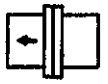
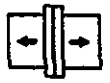
TITLE/DESCRIPTION	KSC CAD CELL NAME	SYMBOL
CYLINDER, FLUID, DOUBLE-ACTING, FIXED CUSHION, ADVANCE AND RETRACT	CYLDAF	
CYLINDER, FLUID, DOUBLE-ACTING, SINGLE END ROD	CYLDAS	
CYLINDER, FLUID, SERVO POSITIONER, HYDRAULIC	CYLSPH	
CYLINDER, FLUID, SINGLE-ACTION	CYLSA1	
CYLINDER, FLUID, SINGLE-ACTION	CYLSA2	
CYLINDER, INTENSIFIER	CYLINT	
DESSICATOR (CHEMICAL DRYER)	DESS	
DETENT	DETENT	
DIRECTION, FLOW, LIQUID, MAIN FLOW	ARLFDH	
DIRECTION, FLOW, LIQUID, SECONDARY FLOW	ARLFD	
DIRECTION, FLOW, PNEUMATIC, MAIN FLOW	ARPFDH	

Table A-1. Preferred GSE Electromechanical Graphic Symbols (cont)

TITLE/DESCRIPTION	KSC CAD CELL NAME	SYMBOL
DIRECTION, FLOW, PNEUMATIC, SECONDARY FLOW	ARPFD	
DISC, BURST	BURDIS	
DISCONNECT, QUICK, WITHOUT CHECK VALVES, CONNECTED	DQNCC	
DISCONNECT, QUICK, WITHOUT CHECK VALVE, DISCONNECTED	DQNCV	
DISCONNECT, QUICK, WITH ONE CHECK VALVE, CONNECTED	DQ1CC2	
DISCONNECT, QUICK, WITH ONE CHECK VALVE, DISCONNECTED	DQCV	
DISCONNECT, QUICK, WITH PNEUMATIC OPERATOR	DQPO	
DISCONNECT, QUICK, WITH TWO CHECK VALVES, CONNECTED	DQCVC	
ENVELOPE, COMPONENT, BASIC	ENVCOM	
ENVELOPE, VALVE, THREE-POSITION	VENV3P	
ENVELOPE, VALVE, TWO-POSITION	VENV2P